

ANALYSIS OF THE COMOVEMENT OF UNEMPLOYMENT IN MIDWESTERN STATES

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ABSTRACT

The current paper investigates the interrelatedness of twelve Midwestern states through the comovement of unemployment rates. Due to their geographic location, we would anticipate similarities and comovement among macroeconomic variables. The results show that although most of the bivariate pairings do show a relationship. Five of the sixty-five pairings show no indication of cointegration among their unemployment rates. Each of these five pairings includes North Dakota. The paper investigates geographic and socioeconomic similarities between these states to try to explain these results.

INTRODUCTION

The Census Bureau divides the United States into four regions: Northeast, Midwest, South, and West. The Midwest region includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. These twelve states are the focus of this study.

We would anticipate similarities between these states due to their geographical proximities to each other. Therefore, this study analyzes the cointegration of their unemployment rates to ascertain comovement on a macroeconomic level between these states. If comovement existed, some anticipation of how a business cycle could affect the entire region could be established.

If cointegration of unemployment rates between specific states was not found to exist, then this could provide information on states that could perform countercyclical to each other throughout a business cycle. This could be helpful information to businesses looking to diversify their interests across states.

DATA AND METHODOLOGY

The data used for analysis is monthly state unemployment rates (seasonally adjusted) for the midwest region states of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. The source of data is FRED (Federal Reserve Economic Database), available at <https://fred.stlouisfed.org/>. The time span of data is January 1976 through July 2021. Table 1 provides the average, maximum, and minimum unemployment rates for each state during the time period studied.

The existence of a long-term relationship among unemployment data will be tested using Johansen (1988) and Johansen and Juselius (1990) methodology for cointegration. The existence of a cointegrating relation would imply a comovement of unemployment rates since series that are cointegrated can be expressed with a causal ordering in at least one direction. The use of

cointegration tests is relatively common in the literature and the reader is referred to Johansen (1988) and Johansen and Juselius (1990) for a complete discussion.

Table 1			
Unemployment Rates by State			
	Average	Maximum	Minimum
Illinois	6.93	16.50	3.50
Indiana	6.00	16.90	2.80
Iowa	4.57	11.10	2.50
Kansas	4.63	12.60	2.90
Michigan	7.83	23.60	3.20
Minnesota	4.82	11.30	2.50
Missouri	5.86	12.50	3.00
Nebraska	3.47	7.40	2.30
North Dakota	3.80	8.70	2.20
Ohio	6.67	16.40	3.80
South Dakota	3.66	9.20	2.40
Wisconsin	5.37	14.80	3.00

EMPIRICAL RESULTS

Prior to cointegration testing, the order of integration needs to be ascertained. The orders of integration of the individual series is determined using the Augmented Dick-Fuller test (Fuller, 1976; Dickey and Fuller, 1981). The unit root tests are provided in Table 2. The null hypothesis is that a unit root exists. For all states, the level of each state's unemployment rate was found to contain a unit root; that is, each variable was found to be nonstationary in their levels and stationary in their first differences. The next step is to test for cointegration among these nonstationary variables.

To investigate the comovement among the nonstationary variables in their levels, the cointegration test is applied on a pairwise basis. The lags lengths to be used in the bivariate cointegration models were determined by the Akaike criteria. The null hypothesis for the maximum eigenvalue statistic is that there are r cointegrating vectors, and the alternative hypothesis is that there are at least $r+1$ cointegrating vectors. The null hypothesis for the trace statistic is that there are r or fewer cointegrating vectors and the alternatives hypothesis is that there are at least $r+1$ cointegrating vectors. The results of these bivariate cointegration tests are reported in Table 2.

Of the sixty-five possible pairings between the states included in the study, only five clearly indicate no cointegrating vectors between them and each of these five pairings include North Dakota. An additional seven pairings have results that are inconclusive. Fifty-three of the sixty-five pairings show evidence of either 1 or 2 cointegrating vectors. The five pairings showing no indication of cointegration are Indiana and North Dakota, Michigan and North Dakota, Missouri and North Dakota, Nebraska and North Dakota, and North Dakota and Wisconsin. Table 3 provides a summary of the cointegration results.

Table 2
UNIT ROOT TESTS

	Augmented Dickey Fuller	
	Level	1 st Difference
Illinois	-0.91	-22.77*
Indiana	-1.16	-27.49*
Iowa	-0.83	-27.36*
Kansas	-0.83	-21.10*
Michigan	-1.22	-17.76*
Minnesota	-0.96	-12.89*
Missouri	-0.88	-26.09*
Nebraska	-0.72	-13.65*
North Dakota	-0.54	-13.24*
Ohio	-1.03	-20.01*
South Dakota	-0.85	-27.73*
Wisconsin	-1.11	-27.86*

Notes: * denotes statistical significance at 1%.

Table 3
COINTEGRATION TEST RESULTS

State Pairings	Trace Statistic		Maximum Eigenvalue		# of vectors
	r=0	r=1	r=0	r=1	
Illinois and Indiana	34.80*	6.53*	28.26*	6.53*	2
Illinois and Iowa	22.90*	4.25*	18.64*	4.25*	2
Illinois and Kansas	21.73*	5.90*	15.83*	3.84*	2
Illinois and Michigan	30.90*	5.84*	25.06*	5.84*	2
Illinois and Minnesota	25.14*	5.33*	19.81*	5.33*	2
Illinois and Missouri	32.10*	5.28*	26.83*	5.28*	2
Illinois and Nebraska	16.26*	3.81**	12.45*	3.81**	2
Illinois and North Dakota	17.76*	5.63*	12.12*	5.63*	2
Illinois and Ohio	31.51*	9.68*	21.83*	9.68*	2
Illinois and South Dakota	37.42*	9.18*	28.24*	9.18*	2
Illinois and Wisconsin	35.44*	6.67*	28.77*	6.67*	2
Indiana and Iowa	16.56*	6.97*	9.58*	6.97*	2
Indiana and Kansas	21.08*	4.42*	21.21*	6.70*	2
Indiana and Minnesota	24.83*	6.33*	18.50*	6.33*	2
Indiana and Missouri	31.66*	7.37*	24.29*	7.37*	2
Indiana and Nebraska	24.69*	8.45*	16.23*	8.45*	2
Indiana and North Dakota	11.86	3.99*	7.86	3.99*	0
Indiana and Ohio	34.51*	5.67*	28.84*	5.67*	2
Indiana and South Dakota	29.15*	5.94*	23.21*	5.94*	2
Indiana and Wisconsin	36.32*	6.68*	29.64*	6.68*	2
Iowa and Kansas	17.93*	2.80**	15.12*	2.80**	2
Iowa and Michigan	14.64**	5.92*	8.71	5.93*	Inconclusive
Iowa and Minnesota	18.22*	5.21*	13.01**	5.21*	2
Iowa and Missouri	14.96**	5.98*	8.99	5.98*	Inconclusive
Iowa and Nebraska	15.97*	6.06*	9.91	6.06*	Inconclusive
Iowa and North Dakota	13.52**	5.08*	8.44	5.08*	Inconclusive
Iowa and Ohio	32.68*	4.95*	27.72*	4.95*	2
Iowa and South Dakota	34.61*	4.22*	30.39*	4.22*	2
Iowa and Wisconsin	16.17*	5.11*	11.06	5.11*	Inconclusive

Kansas and Michigan	18.41*	1.99	16.41*	1.99	1
Kansas and Minnesota	18.30*	3.69**	14.61*	3.69**	2
Kansas and Missouri	22.10*	4.68*	17.42*	4.68*	2
Kansas and Nebraska	18.56*	4.05*	14.05**	4.51*	2
Kansas and North Dakota	18.59*	1.70	16.90*	1.70	1
Kansas and Ohio	18.07*	3.94*	14.13**	3.94*	2
Kansas and South Dakota	19.80*	5.03*	14.77*	5.03*	2
Kansas and Wisconsin	15.49*	3.84*	14.26*	3.84*	2
Michigan and Minnesota	18.31*	5.90*	12.41**	5.90*	2
Michigan and Missouri	24.36*	7.66*	16.70*	7.66*	2
Michigan and Nebraska	17.97*	6.92*	11.06	6.92*	Inconclusive
Michigan and North Dakota	10.91	2.25	8.66	2.25	0
Michigan and Ohio	19.71*	5.56*	14.15**	5.56*	2
Michigan and South Dakota	28.63*	5.34*	23.29*	5.34*	2
Michigan and Wisconsin	19.51*	6.56*	12.95**	6.56*	2
Minnesota and Missouri	37.73*	7.34*	30.39*	7.34*	2
Minnesota and Nebraska	23.86*	7.52*	16.34*	7.52*	2
Minnesota and North Dakota	15.29**	5.67*	9.62	5.67*	Inconclusive
Minnesota and Ohio	34.25*	7.84*	26.41*	7.84*	2
Minnesota and South Dakota	28.25*	8.57*	19.68*	8.57*	2
Minnesota and Wisconsin	31.36*	7.11*	24.25*	7.11*	2
Missouri and Nebraska	17.95*	5.48*	12.47**	5.47*	2
Missouri and North Dakota	13.31	5.51*	7.80	5.51	0
Missouri and Ohio	38.26*	6.09*	32.17*	6.09*	2
Missouri and South Dakota	31.16*	5.87*	25.29*	5.87*	2
Missouri and Wisconsin	32.68*	6.35*	26.33*	6.35*	2
Nebraska and North Dakota	10.50	4.19*	6.31	4.19*	0
Nebraska and Ohio	24.30*	7.16*	17.13*	7.16*	2
Nebraska and South Dakota	32.35*	6.12*	26.23*	6.12*	2
Nebraska and Wisconsin	29.61*	7.54*	22.08*	7.54*	2
North Dakota and Ohio	16.69*	6.15*	10.54*	6.15*	2
North Dakota and South Dakota	16.34*	5.67*	10.67*	5.67*	2
North Dakota and Wisconsin	11.68	4.35*	7.33	4.35*	0
Ohio and South Dakota	37.71*	11.46*	26.25*	11.46*	2
Ohio and Wisconsin	33.40*	6.45*	26.96*	6.45*	2
Wisconsin and South Dakota	25.66*	6.63*	19.03*	6.63*	2

Notes: * (**) denotes statistical significance at 5% (10%).

ANALYSIS OF RESULTS AND THEIR IMPLICATIONS

The results of the cointegration tests indicate a great deal of comovement between unemployment rates of the Midwestern states. According to the World Bank (2010), labor mobility is much higher in the United States than in other developed countries. According to the Bureau of Labor Statistics, an American born between 1957 and 1964 will hold an average of eleven jobs during their lifetime. The laws and regulations of the U.S. make for more effortless labor mobility. For example, Americans have the right to move between states and laws protect them from hire preferences. Laws are also in place that make it easier for employers to hire, fire, and relocate their employees based on their needs. Additionally, the ease of buying and selling property such as homes makes relocating more feasible for workers.

Marsh (1967) found that the most common reason for moving was job-related. Additionally, Marsh found that unemployed people were moderately more willing to move than employed people.

The average unemployment rate of the Midwestern states during the studied time period was 5.3% as compared to a national average of 6.3%. However, there are some marked differences in the averages between the Midwestern states. Specifically, the average unemployment rates for Illinois (6.93%), Michigan (7.83%), Ohio (6.67%), and Wisconsin (5.37%) were above the 6.3% national average. Indiana (6.00%), Iowa (4.57%), Kansas (4.63%), Minnesota (4.82%), Missouri (5.86%), Nebraska (3.47%), North Dakota (3.80%), and South Dakota (3.66%) had unemployment rate averages below the national average.

North Dakota demonstrated the least comovement with the Midwestern states; specifically, lack of comovement with Indiana, Michigan, Missouri, Nebraska, and Wisconsin. None of these states are adjacent to North Dakota, making movement between these particular states less likely. Also, North Dakota is more specialized in agriculture, with fewer manufacturers than the other states.

The future comovement of unemployment rates among Midwestern states or other regions may decrease in the future. Bunker (2016) found there was a decreasing tendency among Americans to move. If this is indeed the trend, then a future, a similar study may well find fewer instances of comovement.

CONCLUSION

This study basically supports that labor mobility is alive and well in the Midwestern region of the U.S. with the exception of North Dakota. That is, most of the unemployment rates exhibited a common trend. This supports the notion that people move for job-related reasons and that unemployed persons are more likely to move.

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